



## All work and no play: Addressing medical students' concerns about duty hours on the surgical clerkship



Trevor J. Barnum<sup>a</sup>, Amy L. Halverson<sup>a, b</sup>, Irene Helenowski<sup>a</sup>, David D. Odell<sup>a, b, \*</sup>

<sup>a</sup> Department of Surgery, Northwestern University Feinberg School of Medicine, 251 E. Huron St., Suite 3-150, Chicago, IL, USA

<sup>b</sup> Center for Healthcare Studies, Institute for Public Health and Medicine, 633 N. St. Clair St., 20th Floor, Chicago, IL, USA

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### ABSTRACT

**Background:** Given the option of preferencing rotations for a 3rd year core surgery clerkship, we observed students often requested services perceived as less time-intensive. We compare self-reported duty hours with academic outcomes.

**Methods:** We examined duty hours from 165 third-year medical students on a surgery clerkship at a single institution for academic year 2016–2017. Partial correlations and logistic regression modeling were used to assess the number of hours medical students worked on academic outcomes.

**Results:** Medical student duty hours did not significantly correlate with the NBME Surgery Subject examination score ( $r = 0.08$ ;  $p = 0.34$ ), CPE score ( $r = 0.14$ ;  $p = 0.09$ ) or a clerkship grade of Honors (OR 0.993; CI 0.925–1.065). Prior completion of an internal medicine clerkship was correlated with a higher NBME Surgery Subject examination score ( $r = 0.27$ ;  $p < 0.001$ ).

**Conclusion:** This analysis demonstrates duty hours on a surgical clerkship do not correlate with academic performance. These data can be used to counsel students on career planning and choosing surgical rotations based on interest and not perceived workload.

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### Summary

Medical student duty hours on a surgery clerkship are not associated with negative academic outcomes. Students should be counseled to pursue rotations on surgery clerkships based on interest and not perceived work load.

### Introduction

A primary objective of the required clinical rotations during medical school is to provide students with a broad range of robust experiential learning opportunities. Historically, this has been synonymous with students spending many hours in the clinical setting. More recently, increased emphasis has been placed on the

examination and regulation of work hours for medical trainees at all levels. While the Liaison Committee on Medical Education (LCME) suggests broadly that medical schools monitor students' time spent in academic activities,<sup>1</sup> there is not a consensus among medical schools as to the optimal number of hours per week medical students should work,<sup>2</sup> nor does the Association of American Medical Colleges (AAMC) provide guidance regarding duty hours in undergraduate medical education (UME). By contrast, resident physician duty hours are closely regulated. The Accreditation Council for Graduate Medical Education's (ACGME) mandates a maximum 80-h work week (averaged over a 4-week period) along with regulations addressing shift length and time off from clinical duties.<sup>3</sup> Many medical schools have adopted these ACGME duty hour regulations for medical students as well due to a lack of discrete data or policy direction in the undergraduate medical education literature.

Despite these regulations, it is recognized that hours commitments for trainees vary between specialties and even between practices within a single specialty. This variability in time commitment during a rotation can be particularly worrisome to medical students under increasing pressure to succeed academically and compete for residency positions. Better understanding

\* Corresponding author. Surgical Outcomes and Quality Improvement Center, Department of Surgery and Center for Healthcare Studies, Northwestern University, Feinberg School of Medicine, 633 N. St. Clair Street; 20th Floor, Chicago, IL, 60611, USA.

E-mail addresses: [trevor.barnum@nm.org](mailto:trevor.barnum@nm.org) (T.J. Barnum), [amy.halverson@nm.org](mailto:amy.halverson@nm.org) (A.L. Halverson), [i-helenowski@northwestern.edu](mailto:i-helenowski@northwestern.edu) (I. Helenowski), [dodell@northwestern.edu](mailto:dodell@northwestern.edu) (D.D. Odell).

### Abbreviations

NBME	National Board of Medical Examiners
CPE	Clinical Performance Evaluation
LCME	Liaison Committee on Medical Education
AAMC	Association of American Medical Colleges
UME	Undergraduate Medical Education
OSCE	Objective Structured Clinical Examination

this perceived imbalance prompted us to examine how the hours medical students work affect their academic performance. The third-year surgical clerkship at our institution includes two separate, four-week blocks; one in “abdominal surgery” and the other in a “surgical sub-specialty”. Prior to rotating on the surgical clerkship, students are asked to rank their choices of available surgical services. Rotations are assigned based on student preference and resource availability. Additionally, clerkship faculty attempt to “balance” the rotation assignments based on perceived time demands. A commonly cited concern cited by our students when selecting rotations is the perceived duty hour expectations, for fear of performing poorly on end of clerkship examinations such as the National Board of Medical Examiners’ (NBME) Surgery Subject Examination or Objective Structured Clinical Examination (OSCE). The validity of these perceptions is not well understood, and it is not known if the time spent in patient care has an opportunity cost in terms of preparation for standardized or clinical examinations.

The purpose of this study is to examine the relationship between the clinical hours worked by medical students and objective measures of academic performance including surgery clerkship grade, NBME Subject Examination score, OSCE performance and clinical performance evaluation (CPE).

### Methods

This study includes 165 medical students enrolled in the 8-week core surgery clerkship during the 2016–2017 academic year. A total of 175 students completed the Surgery Clerkship during the study period and 10 students were excluded due to incomplete duty hour data. Students were assigned to two, four-week blocks on one each of 10 “abdominal” surgical services and 9 surgical subspecialty services. Students were assigned a rotation by the clerkship coordinator based on stated student preferences and space available. Students are required to round one morning of each weekend. Additionally, students take one 12-h weekend on-call shift during the eight-week clerkship. Students were required to submit weekly reports of the number of hours worked during the prior week. Should a duty hour violation be reported, the clerkship director contacts the chief resident and attending on the service on which the violation took place.

We examined the impact of average weekly hours for periods wherein students were fully assigned to clinical duties (weeks 2–7). Weeks one and eight were excluded as students were excused from clinical activity for 2–3 days per week for orientation, educational, and student assessment activities respectively. Data used for this study were accessed from an institutional education database approved by the Northwestern University Institutional Review Board.

### Academic outcomes

The primary outcomes examined were the correlation between medical student duty hours and overall clerkship grade, CPE

average and NBME Surgery Subject Examination score. We also assessed the influence of each student’s prior experience entering the surgery clerkship on their academic performance in the clerkship. Hours were compiled for each student along with clinical rotation, demographic and performance information.

Students were evaluated on a 3-tiered grading system consisting of Pass, High Pass, and Honors. The clerkship grade consists of 3 main components, the NBME Surgery Subject Examination, clinical performance evaluations (CPE), and an Observed Structured Clinical Examination (OSCE). To be eligible for a grade of Honors, students must meet minimum criteria in all three components of the overall grade to include a score on the NBME Surgery Subject Examination that meets or exceeds the national average, a CPE average greater than or equal to 7 on a 1–9 scale and an OSCE score above the cohort mean. For analytic purposes, clerkship grade was dichotomized as ‘Grade of Honors’ or no ‘Grade of Honors’ to allow for logistic regression analyses.

The OSCE consists of five stations covering the topics of general surgery, urology, communication, orthopedic surgery and a basic technical skill. The score components include communication, history taking, physical examination and clinical decision making. The CPE grade is the average of four evaluations – one each from a faculty and resident for each four-week rotation. The CPE includes 6 domains: professionalism, communication, advocacy, collaboration, scholarship, clinical aptitude. Students take the proctored NBME Surgery Subject Examination at the conclusion of the 8-week surgery clerkship. Scores are evaluated based on the “new score scale” implemented by the NBME in August of 2015.

### Statistical analysis

Continuous variables were summarized by means, standard deviations, medians, and interquartile ranges, while categorical variables were summarized by frequencies and percentages. Univariable comparisons between groups were assessed via the Wilcoxon rank-sum test for continuous variables and Fisher’s exact test for categorical variables. Student duty hours were examined in three ways: average weekly hours, total hours worked during the clerkship, and maximum number of hours worked in a single week. A multivariable logistic regression model was constructed to examine factors influencing student’s clerkship grade, adjusting for rotations, step scores, age, and previous training completed. Partial correlations were employed for continuous outcome variables, once more adjusting for rotation specialty, USMLE examination scores, age, and previous clerkships completed. Analyses were conducted in SAS v9.4. All analyses were based on two-tailed tests with the threshold for statistical significance determined by an  $\alpha$ -value of 0.05 or less. Power calculations were performed to assess the magnitude of effect in performance which could be measured in the given sample. With 165 subjects there was an 87.02% power to detect a 17.5% difference in overall clerkship grade. In addition, there was an 80% power to detect a difference of 5 points in means for the CPE average and NBME Surgery Subject Examination scores. A correlation of 0.20 based on 165 subjects would be deemed significant at the 5% level with 82.73% power.

### Results

Complete data were available for 165 medical students. The median age of students was 25 years (IQR 25, 27) and 49% were female (Table 1). The median number of hours worked by students per week was 57.7 h (IQR 52.2, 61.4). The majority of students had prior clerkship experience relevant to surgery; 66% had previously completed an internal medicine clerkship and 56.6% an obstetrics and gynecology clerkship. The range in duty hours between

**Table 1**  
Student characteristics.

Characteristic	Data
All students, number	165
Age, median (IRQ)	25 (25, 27)
Female, number (%)	81 (49.09%)
Previously completed Medicine clerkship	101 (61.21%)
Average USMLE Step 1 Score	240 (229,252)
Average MCAT score	36 (34, 37)
CPE (Scale of 1–9), IQR	7.5 (7, 8)
Honors clerkship grade, number (%)	75 (45.45%)
NBME Surgery Subject examination, IQR	78 (74,82)

surgical services was 17.5 h/week (Range: 46.8–64.4 h). Students on the male urology rotation reported working the greatest number of hours on average (64.4 [SD 7.2]) while students on the breast surgery reported working the least (46.9 [SD 8.0]) (Table 2). This difference was significant ( $p < 0.001$ ).

The average number of hours worked per week did not correlate with a student's NBME Subject examination score ( $p = 0.34$ ), the average CPE ( $p = 0.09$ ) or a final clerkship grade of honors (OR 0.99, CI 0.93–1.07) students (Table 3). Further, neither the total cumulative hours worked by medical students in weeks 2–7, nor the maximum number of hours worked in any given week were associated with any of the primary outcomes.

Four 80-h/week duty hour violations were identified during the study period. Of these students, 2 received a clerkship grade of honors, 1 received a grade of high-pass and 1 received a grade of pass. In addition, all but one of those who had a duty hours violation had completed the medicine clerkship prior to rotating on the surgery clerkship and two of the four violations occurred in the final clerkship of the academic year.

In a subsequent multivariable analysis, we examined the influence of previously completed clerkships and previous examination performance in addition to duty hours (Table 4). We found weak correlations between prior completion of the Medicine ( $r = 0.27$ ;  $p < 0.001$ ) and Primary Care clerkships ( $r = 0.26$ ;  $p = 0.001$ ) with improved performance on the NBME Surgery Subject examination. Prior completion of the Medicine Clerkship was also weakly associated with an improved average CPE score ( $r = 0.27$ ;  $p = 0.001$ ). We included USMLE Step 1 scores in the model to normalize student testing ability and, to a lesser extent, baseline medical knowledge. There was a moderate positive correlation between the

**Table 2**  
Mean duty hours for each rotation in the surgery clerkship.

Rotation	Mean Duty Hours	SD
Male Urology	64.38	7.24
General Thoracic Surgery	64.29	4.80
Colorectal Surgery	63.96	4.50
Female Urology	63.26	6.00
Trauma & Emergency Surgery	63.20	7.92
Urologic Oncology	61.98	8.84
Surgical Oncology	61.92	6.60
Urologic Surgery	60.81	4.19
Pediatric Surgery	60.16	7.02
Vascular Surgery	59.61	6.89
Minimally Invasive Surgery	58.72	6.90
General Surgery at a Veterans Affairs Hospital	57.07	3.99
Transplant Surgery	55.98	7.56
Plastic & Reconstructive Surgery	54.75	5.55
Endocrine Surgery	54.13	5.33
General Surgery at an Academic Medical Center	53.79	7.80
General Surgery at a Community Hospital	49.64	4.03
Orthopedic Surgery	49.06	6.30
Breast Surgery	46.85	7.96

NBME Subject examination core and the USMLE Step 1 Score ( $r = 0.56$ ;  $p < 0.001$ ) (Table 5). In addition, the USMLE Step 1 score was found to be associated with a clerkship grade of honors (OR 0.98,  $p = 0.04$ ).

## Discussion

The findings of this study suggest the number of hours a student works during the surgical clerkship does not influence academic performance. When designing the curriculum for the surgery clerkship, we strive to identify the optimal balance of didactic teaching, experiential learning, and free time for individual study or other activities. However, contrary to popular conception, the amount of time spent engaged in clinical activities on the surgical rotation does not appear to adversely impact academic performance during the clerkship. We have attempted to control for a number of baseline student characteristics which may be related to success on the surgery clerkship. Learners have varying levels of interest in a particular specialty as well as variable baseline knowledge of surgical topics. In addition to gaining knowledge and skills, the clerkship experience helps to shape students' attitudes and expectations regarding a surgical career.

Perceptions of variability in duty hours between rotations appears to be justified as our data show a significant difference between those rotations with the least and greatest average number of hours worked per week ( $p < 0.001$ ). While these differences exist, this variability in student work hours was not found to have an effect on their academic performance. Gerhart and colleagues also examined the impact of rotating on subjectively "busy" surgical services and performance on the NBME surgical subject examination compared to students on "slow" services.<sup>4</sup> The authors found no difference between these groups, but were unable to quantify the actual student time commitment on 'busy' and 'slow' rotations. The incorporation of prospectively collected duty hours records in our study allows for a more objective assessment of the correlation between time spent on clerkship and academic outcomes.

The positive correlation between the USMLE Step 1 score and the NBME Subject examination score observed in our study is consistent with prior publications.<sup>5–7</sup> Ryan and colleagues found that USMLE Step 1 scores predicted 23–44% of variance in NBME subject examinations across clerkships.<sup>8</sup> Both the NBME subject examination and CPE scores were associated with prior completion of internal medicine or primary care clerkships in our study. Other authors have suggested that cumulative experience may enhance performance in subsequent clerkships.<sup>9,10</sup> For example, a study of OSCE and clinical performance found that clerkship rotation scores increased over time irrespective of clerkship sequence.<sup>11</sup> The authors suggest it is the cumulative experience which leads to improved student performance, not the specific clerkship order.

Similarly, student OSCE scores did not correlate with duty hours in this study. Unlike the NBME and CPE, OSCE scores were not influenced by prior clerkship experience. While this is the first study to our knowledge which directly compares duty hours and OSCE performance, there are data indicating that OSCE performance improves as the number of patients a student<sup>12,13</sup> or resident<sup>14</sup> interacts with increases. However, the relationship between duty hours and patient interaction is unlikely to be purely linear and may account for the lack of difference observed in our study. Our data may suggest there are differences in how students experience time spent on a rotation, for example performing clerical tasks, as opposed to the sheer number of patients seen.

The overall grade students received was not correlated with their duty hours. This is an expected finding given that the individual components of our grading system were not found to

**Table 3**  
Primary outcome data for clerkship duty hours variables compared to academic performance on the surgery clerkship.

Variable	NBME Surgery Subject examination Score, r (CI) [p-value]	CPE Average, r (CI) [p-value]	OSCE grade, r (CI) [p-value]	Clerkship Grade of Honors, odds ratio (95% CI [p-value])
Average clerkship duty hours per week (weeks 2–7)	0.08 (–0.09,0.25) [0.34]	0.14 (–0.02,0.31) [0.09]	–0.10 (–0.27,0.07) [0.23]	0.993 (0.925, 1.065) [0.83]
Total clerkship duty hours (weeks 2–7)	0.09 (–0.08,0.25) [0.31]	0.15 (–0.02,0.31) [0.09]	–0.06 (–0.23,0.10) [0.46]	0.994 (0.983, 1.006) [0.33]
Max clerkship duty hours (weeks 2–7)	–0.17 (–0.32,0.00) [0.054]	0.02 (–0.15,0.19) [0.81]	–0.12 (–0.28,0.05) [0.16]	1.034 (0.975, 1.097) [0.26]

**Table 4**  
Partial correlation and logistic regression models of students completing selected clerkships prior to entering the surgery clerkship.

Clerkship completed prior to surgery clerkship	NBME Surgery Subject examination Score, r (CI) [p-value]	CPE Average, r (CI) [p-value]	OSCE grade, r (CI) [p-value]	Clerkship Grade of Honors, odds ratio (95% CI [p-value])
Medicine	0.27 (0.11,0.42) [0.0008]	0.27 (0.11,0.41) [0.001]	0.04 (–0.12,0.20) [0.65]	0.506 (0.207, 1.239) [0.14]
Psychiatry	0.13 (–0.03,0.29) [0.11]	0.04 (–0.12,0.20) [0.64]	–0.12 (–0.28,0.04) [0.15]	1.088 (0.464, 2.55) [0.85]
Pediatrics	0.14 (–0.02,0.30) [0.09]	0.11 (–0.05,0.27) [0.19]	–0.04 (–0.20,0.12) [0.61]	1.428 (0.604, 3.376) [0.42]
Obstetrics/Gynecology	0.11 (–0.06,0.26) [0.20]	0.05 (–0.11,0.21) [0.55]	0.00 (–0.16,0.16) [0.98]	1.426 (0.637, 3.192) [0.39]
Primary Care	0.26 (0.11,0.41) [0.001]	0.18 (0.02,0.34) [0.03]	0.11 (–0.06,0.27) [0.20]	0.452 (0.193, 1.055) [0.07]

**Table 5**  
Partial correlation and logistic regression model of student's prior performance on standardized testing compared to academic performance in the surgery clerkship.

Previous standardized testing scores	NBME Surgery Subject examination Score, r (CI) [p-value]	CPE Average, r (CI) [p-value]	OSCE grade, r (CI) [p-value]	Clerkship Grade of Honors, odds ratio (95% CI [p-value])
USMLE Step 1	0.56 (0.43,0.66) [<.0001]	0.08 (–0.09,0.24) [0.37]	0.32 (0.17,0.46) [<.0001]	0.977 (0.955, 0.999) [0.04]

correlate with student's duty hours. Grades in medical education are not standardized and potentially vary in reliability about student performance.<sup>15–18</sup>

While there is a paucity of literature specifically focused on duty hours in undergraduate medical education, data from the graduate medical education literature may provide some context to aid in interpretation of the current study. One study of 54 hospitals<sup>19</sup> and another single institution study<sup>20</sup> found there was no difference in mean ABSITE (American Board of Surgery In-Training Examination) examination scores before and after the 2011 ACGME duty hour reform took place. When looking at the ABSITE and American Board of Surgery Certifying and Qualifying examinations, the FIRST trial investigators showed that flexible duty hours policies were not associated with differences on these examination scores when compared to traditional resident duty hours.<sup>21</sup> Similarly, Sugar and colleagues looked at residents who took call the night prior to their ABSITE score and found no difference in scores compared to their peers.<sup>22</sup> Our findings reflect a similar trend in the UME population, in that variability of duty hours within the 80-h limit are not associated with academic outcomes. This information should reassure students that they are not necessarily handicapped by being on a service with a higher work hour demand.

This study has several discrete limitations which should be considered when interpreting the data. Duty hours data for this study were self-reported by the student and may be subject to both recall bias and either under- or overreporting of hours. Students may under-report their duty hours for fear of violating a medical school policy. Conversely, Casey and colleagues suggested that medical students may actually overestimate the hours they work when self-reporting duty hours.<sup>23</sup> However, this study looked at the number of hours each student was “scheduled” to work, not considering staying beyond what is scheduled to finish documenting or unplanned learning experiences. Moreover, self-reporting of duty hours is the common standard in many GME

programs, including at our institution. The data reviewed here are from a single institution over a single academic year, and this may impact the generalizability of the findings to other medical school settings. As we limited this analysis to the surgical clerkship, it is unknown how duty hours impact academic performance in non-surgical clerkships or sub-internships.

## Conclusions

Success arises from a combination of talent and effort.<sup>24</sup> This study shows no correlation in the number of hours worked by medical students and their academic outcomes. Importantly, other factors such as previous test scores and clerkship sequence are correlated with academic outcomes. These data can be used to counsel students about choosing surgical rotations based on interest and not perceived workload. Future work should include multiple institutions and clerkship durations to determine if outcomes are modified due to variable lengths in clerkships. Other work of interest may include following a cohort to the Match and examining the relationship between time worked on clerkships to career choice.

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## Conflicts of interest

The authors report no conflicts of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amjsurg.2018.12.012>.

## References

1. *Functions and structure of a Medical school*; 2018. <http://lcme.org/publications/#Standards>. Accessed January 1, 2018.
2. Friedman E, Karani R, Fallar R. Regulation of Medical student work hours: a national survey of deans. *Acad Med*. 2011;86:30–33.
3. Professionalism ATFoQCa. *The ACGME 2011 Duty Hour Standards: Enhancing Quality of Care*. Supervision: and Resident Professional Development Chicago, IL; 2011.
4. Gerhardt JD, Filipi CJ, Watson P, Tselentis R, Reeves J. Are long hours and hard work detrimental to end-clerkship examination scores? *Am J Surg*. 1999;177:132–135.
5. George AB, Schuster A, Helmer SD, et al. Do medical student's surgical examination scores correlate with performance markers? *Am J Surg*. 2014;208.
6. Casey PM, Palmer BA, Thompson GB, et al. Predictors of medical school clerkship performance: a multispecialty longitudinal analysis of standardized examination score and clinical assessments. *BMC Med Educ*. 2016;16:1–8.
7. Ryan MSC-GJ, Glenn SN, Browning JD, Anand RJ. Does the NBME Surgery Shelf exam constitute a "double jeopardy" of USMLE Step 1 performance? *Am J Surg*. 2017;213:325–329.
8. Ryan MS, Bishop S, Browning J, et al. Are scores from NBME subject examinations valid measures of knowledge acquired during clinical clerkships? *Acad Med*. 2017;92:847–852.
9. Kies SM, Roth V, Rowland M. Association of third-year medical students' first clerkship with overall clerkship performance and examination scores. *J Am Med Assoc*. 2010;304:1220–1226.
10. Ouyang WCM, Swanson DB. US medical student performance on the NBME subject examination in Internal Medicine: do clerkship sequence and Clerkship length matter? *J Gen Intern Med*. 2015;30:1307–1312.
11. Doyle CWL, Wimmers PF. Clinical clerkship timing revisited: support for non-uniform sequencing. *Med Teach*. 2013;35:586–590.
12. Kim JY, Myung SJ. Could clinical experience during clerkship enhance students' clinical performance. *BMC Med Educ*. 2014;14:1–5.
13. Albert DV, Brorson JR, Amidei C, Lukas RV. Case logs in the assessment of medical students in the neurology outpatient clinic. *Neurology*. 2014;82:e138–e141.
14. McCoy CP, Stenerson MB, Halvorson AJ, Homme JH, McDonald FS. Association of volume of patient encounters with residents' in-training examination performance. *J Gen Intern Med*. 2013;28:1035–1041.
15. Kreiter CD, Ferguson KJ. An investigation of the generalizability of medical school grades. *Teach Learn Med*. 2016;28:279–285.
16. Bowen RES, Grant WJ, Schenarts KD. The sum is greater than its parts: clinical evaluations and grade inflation in the surgery clerkship. *Am J Surg*. 2015;209:760–764.
17. Grover S, Swisher-McClure S, Sonsnowicz S, et al. Grade inflation in medical student radiation oncology clerkships: missed opportunities for feedback. *Int J Radiat Oncol Biol Phys*. 2015;92:740–744.
18. Fazio SB, Papp KK, Torre DM, DeFer TM. Grade inflation in the internal medicine clerkship: a national survey. *Teach Learn Med*. 2013;25:71–76.
19. Rajaram R, Chung JW, Jones AT, et al. Association of the 2011 ACGME resident duty hour reform with general surgery patient outcomes and with resident examination performance. *J Am Med Assoc*. 2014;312.
20. Thorp J, Dattalo M, Ghanem KG, Christmas C. Implementation of 2011 duty hours regulations through a workload reduction strategy and impact on residency training. *J Gen Intern Med*. 2016;31:1475–1481.
21. Blay E, Hewitt DB, Chung JW, et al. Association between flexible duty hour policies and general surgery resident examination performance: a flexibility in duty hour requirements for surgical trainees. *J Am Coll Surg*. 2017;224:137–142.
22. Sugar JG, Chu QD, Cole PA, Li BD, Kim RH. Effect of January vacations and prior night call status on resident ABSITE performance. *J Surg Educ*. 2013;70:720–724.
23. Casey C, Senapati S, White CB, Gruppen LD, Hammoud MM. Medical students self-reported work hours: perception versus reality. *Am J Obstet Gynecol*. 2005;193:1780–1784.
24. Duckworth ALPC, Matthews MD, Kelly DR. Grit: perseverance and passion for long-term goals. *J Pers Soc Psychol*. 2007;92:1087–1101.